Wisconsin
Department of Commerce

Evaluation # 200246-I (Replaces 980093-I)

Safety & Buildings Division
201 West Washington Avenue
P.O. Box 2658
Madison, WI 53701-2658

Wisconsin
Building Products Evaluation

Material	eForm and iForm Insulating Concrete Forms
Manufacturer	Reward Wall Systems®, Incorporated 4115 South 87th Street Omaha, NE 68127

SCOPE OF EVALUATION

GENERAL: This report evaluates the use of the Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms, manufactured by Airlite Plastics, Tuscarora, Inc., and Tri State Foam. The eForm and iForm insulating concrete forms were evaluated as a permanent form work and insulation system for reinforced concrete, beams, lintels, exterior and interior walls, and foundation and retaining walls. The Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms were also evaluated for the fire safety requirements for foam plastic, structural and thermal performance requirements for the code sections listed below.

This review includes the cited **Comm** code requirements below in accordance with the current **Wisconsin Uniform Dwelling Code (UDC), (for 1- and 2-family dwellings):**

- **Foam Plastic:** The Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms were evaluated in accordance with the fire safety requirements of **s. Comm 21.11**.
- **Structural:** The Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms were evaluated in accordance with the structural requirements of **s. Comm 21.02** and **s. Comm 21.02(3)(c)**.
- **Thermal Performance:** The Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms were evaluated in accordance with the thermal performance calculation requirements of **s. Comm 22.31**

The cited code requirements below are in accordance with the **Wisconsin Building and Heating, Ventilating and Air conditioning Code applicable to buildings approved prior to July 1, 2002:**

- **Foam Plastic:** The Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms were evaluated in accordance with the fire safety requirements of **s. Comm 51.06(2)**.
- **Structural:** The Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms were evaluated in accordance with the structural requirements of **s. Comm 53.10** through **s. 53.12**, **s. 53.16**, **53.316(1)** and **53.40**.

- **Thermal Performance:** The Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms were evaluated in accordance with the thermal performance calculation requirements of **s. Comm 63.17** and **s. Comm 63.18**.

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This review includes the cited **International Building Code (IBC)** requirements below in accordance with the **Wisconsin Amended IBC Code (effective 7/01/02):**

- **Foam Plastic:** The Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms were evaluated in accordance with the fire safety requirements of **ss. IBC 2603.1**, **2603.2** and **s. IBC 2603.3**.
- **Structural:** The Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms were evaluated in accordance with the structural requirements of **IBC Chapter 16**. Structural calculations shall be submitted (job-to-job basis) in accordance with IBC Chapter 16 for Live, Ground Snow, Roof, Wind and Seismic Loads. See LIMITATIONS sections.
- **Thermal Performance:** The Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms were not evaluated. Data/other requirements in accordance with the **IECC** as modified by **s. Comm 63.0004 (3)**, **s. IECC 502.2.1**, and **IECC Chapter 8** will be submitted on a job-to-job-basis.

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DESCRIPTION AND USE

General: The complete wall system, Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms are assembled with steel reinforcement with concrete cast inside the forms. The eForm and iForm insulating concrete forms are a stay-in-place insulating system for use in above and below grade construction of commercial and multi-family structures. The eForm and iForm insulating concrete forms consist of individual lightweight foam blocks made of two pieces of expanded polystyrene (EPS) held together with plastic inner ties. The tie faces are recessed ¼-inch below the surface of the EPS for the eForm and ½-inch below the surface for the iForm.

Both the eForm and iForm insulating concrete forms form a hollow block assembly designed to form a bearing wall after being stacked and filled with concrete. The block halves are connected by sections of high-density polypropylene. The expanded polystyrene sections from the outside surfaces of the finished wall, held together by the polypropylene sections allow the concrete to pass through. The minimum thickness of concrete in the finished eForm wall assembly is 2-3/8 inches, and 4-1/8 inches for the 9-1/4 inch and 11 inch eForm, respectively. The eForm is manufactured in 6- and 8-inch nominal core thickness, and are 16 inches tall and 48 inches long with thickness of 9-1/4 inches (6-inch nominal core) and 11 inches (8-inch nominal core). The iForm is available in 9-, 11- and 13-inch widths having a respective 4, 6 and 8 inch concrete core. The iForm is 16 inches tall and 48 inches long.

The polypropylene section ties, made by Airlite for Reward Wall Systems, Inc., are not considered an essential part of the assembly. Ties hold the EPS sides together at the same time of concrete pouring. The ties are encapsulated in the concrete and are of such a small cross section, that their presence is insignificant with respect to fire performance.

eForm Composition: The EPS is molded so that it creates a "waffle" type interior concrete configuration. The solid concrete wall consist of vertical cores 12 inches on center and horizontal cores 16 inches on center. The ties, a part of the form hold the form together during concrete pouring, and also act as furring strips for fastening interior and exterior finishes to the wall with screws.

iForm Composition: The EPS is molded so that it creates a straight, monolithic flat wall interior concrete configuration. The ties, a part of the form hold the form together during concrete pouring, and also act as furring strips for fastening interior and exterior finishes to the wall with screws. The form is designed with plastic "tie rods" on 8-inch vertical centers going up the block from bottom to top.

Steel reinforcement for both the eForm and iForm insulating concrete forms is placed in the form cavities as required by design, and at the required spacing. Reinforcement consists of both horizontal and vertical bars. ACI 318 requires a minimum amount of reinforcement. Lintels require proper reinforcement design around window and door openings. The concrete design and placement will comply with the ACI 318. Generally, the concrete mix will consist of a minimum

compressive strength of 3,000 psi, a slump of 5-1/2 inches to 6-1/2 inches and maximum aggregate size of 3/8-inch to ½-inch.

For unit block configurations and construction details, see the Reward Wall Systems® Installation Construction Manual.

The molded modified expandable polystyrene bead manufacturers include:

Approved Raw Materials:

EPS Resin Bead Material	Manufacturer
Styrochem® Types: EPS MA-500, -550 & -590, MB-500, -550, -590 & MB-50CC, MC-590, MBC-590, MBT-500 & -590	Styrochem International, Inc. 11591 Business Hwy. 287 North Ft. Worth, TX 76179
Styropor® Types: BF 122, 222, 322, 326, 327, & 422, BFL 122, 222, 322, & 422, F 214, & 314	BASF Corporation 3000 Continental Drive North Mount Olive, NJ 07840
Dylite® Types: 33M, 35M, and M77	Nova Chemicals Inc. 400 Frankfort Road Monaca, PA 15061
Grade 86: Types: 3486A, 4486B, 4786B, Grade 54: Types: 254, 454, 554, 754, and 900 Grade 40:	Huntsman Chemical Corporation 2000 Eagle Gate Tower Salt Lake City, UT 84111
Plastic for Inserts	
High Density Polyethylene, T50-5500(-119), & T50-4400(-119) Alathon® M5370……	Solvay Polymers 3333 Richmond Ave. Houston, TX 77098-3099 Equistar Chemicals, LP 1221 McKinney, STE., 1600 Houston, TX 77252-2583

TESTS AND RESULTS

The tests and results listed below cover the **Wisconsin Uniform Dwelling Code (UDC)**, (for 1- and 2-family dwellings), pre July 1, 2002 **Wisconsin Building Code** and the current **IBC** requirements **(effective July 1, 2002):**

Modified ASTM E84 testing was conducted on Reward Wall Systems®, insulating concrete forms, the results are as follows:

Test Specimen	Flame Spread Index	Smoke Developed Index
Ceiling Burning Only	25	450
Floor Burning Only	40	490

Reward Wall Systems® insulating concrete forms were tested and met the requirements of ASTM Method E119 Fire Tests Of Building Construction And Materials for various time periods and loads as indicated in the table below.

Authorized Listing Mark:

ASTM E119/ANSI/UL 263/ NFPA 251: Fire-Rated Reward Wall Systems

Design No.	Form Type	Interior Wall Finish[3,4]	Minimum Steel Reinforcement[6]
BW-500[10] Bearing wall: 4 hr. Design load: 5,000 lb./ft.[1,2]	eForm 11" width	Not required for fire-resistance assembly rating[5]	Vertical: #5, 12" o.c. in vertical cores Horizontal: #5, 16" o.c. in horizontal cores
BW-501[10] Bearing wall: 3 hr. Design load: 3,000 lb./ft.[1,2]	eForm 9-1/4" width	Required for fire-resistive assembly rating: 5/8" Type X gypsum wallboard, fastened 12" o.c. in field and 8" o.c. at perimeter	Vertical: #5, 24" o.c. in vertical cores Horizontal: #5, 24" o.c. in horizontal cores
NBW 500[10] Nonbearing wall: 4 hr.[1,2]	eForm 11" width	Not required for fire-resistance assembly rating[5]	Not required for fire-resistance rating[7]
NBW 501[10] Nonbearing wall: 3 hr.[1,2]	eForm 9-1/4" width	Required for fire-resistive assembly rating: 5/8" Type X gypsum wallboard, fastened 12" o.c. in field and 8" o.c. at perimeter	Not required for fire-resistance rating[7]
BW-502[10] Bearing wall: 4 hr. Design load: 5,000 lb./ft.[1,2]	iForm 13" width	Not required for fire-resistance assembly rating[5]	Vertical: #5, 12" o.c. in vertical cores Horizontal: #5, 16" o.c. in horizontal cores
BW-503[10] Bearing wall: 3 hr. Design load: 3,000 lb./ft.[1,2]	iForm 11" width	Not required for fire-resistance assembly rating[5]	Vertical: #5, 24" o.c. in vertical cores Horizontal: #5, 24" o.c. in horizontal cores
NBW 502[10] Nonbearing wall: 4 hr.[1,2]	iForm 13" width	Not required for fire-resistance assembly rating[5]	Not required for fire-resistance rating[7]
NBW 503[10] Nonbearing wall: 3 hr.[1,2]	iForm 11" width	Not required for fire-resistance assembly rating[5]	Not required for fire-resistance rating[7]
BW-504[10] Bearing wall: 1 hr. Design load: 2,250 lb./ft.[8]	iForm 9" width	Not required for fire-resistance assembly rating[5]	Vertical: #5, 24" o.c. in vertical cores Horizontal: #5, 24" o.c. in horizontal cores
BW-505[10] Bearing wall: 2 hr. Design load: 2,250 lb./ft.[9]	iForm 9" width	Not required for fire-resistance assembly rating[5]	Vertical: #5, 24" o.c. in vertical cores Horizontal: #5, 24" o.c. in horizontal cores
BW-506[10] Bearing wall: 2 hr. Design load: 2,250 lb./ft.[8]	iForm 9" width	Required for fire-resistive assembly rating: 1/2" Type X gypsum wallboard, fastened 12" o.c. in field and 8" o.c. at perimeter, both sides	Vertical: #5, 24" o.c. in vertical cores Horizontal: #5, 24" o.c. in horizontal cores
NBW 507[10] Nonbearing wall: 1 hr.[8]	iForm 9" width	Not required for fire-resistance assembly rating[5]	Not required for fire-resistance rating[7]
NBW 508[10] Nonbearing wall: 2 hr.[9]	iForm 9" width	Not required for fire-resistance assembly rating[5]	Not required for fire-resistance rating[7]
NBW 509[10] Nonbearing wall: 2 hr.[8]	iForm 9" width	Required for fire-resistive assembly rating: 1/2" Type X gypsum wallboard, fastened 12" o.c. in field and 8" o.c. at perimeter, both sides	Not required for fire-resistance rating[7]

Notes:
1. The Reward Wall System must be constructed with normal-weight concrete with a minimum compressive strength of 3,000 psi at 28 days.
2. The tabulated design load is based on a maximum wall height of 10 feet.
3. The layer of gypsum wallboard required to achieve the hourly rating must be attached to the interior face of the exterior Reward Wall, and to both sides of an interior Reward Wall. The wallboard must be fastened with 1-1/4-inch-long drywall screws, spaced 8 inches on center. Wallboard joints will be treated with joint tape and compound.
4. An exterior wall covering is required. An approved exterior wall covering permitted by the code or recognized in a current evaluation report, applied to the exterior side of the Reward System, will not diminish the fire-resistive rating of the wall assembly.
5. An approved thermal barrier is required to separate the interior of the building.
6. Reinforcement for the structural design must comply with the building code. Greater reinforcement dimensions and closer spacing patterns are acceptable. Lesser reinforcement dimensions and wider spacing are acceptable when design loads are less than the rated load.
7. Structural reinforcement must be placed in accordance with the structural calculations as required by the building code.
8. Concrete must be salacious aggregate, carbonate aggregate, sand-lightweight, or lightweight concrete, having a minimum 3,000 psi compressive strength.
9. Concrete must be sand-lightweight, or lightweight concrete, having a minimum 3,000 psi compressive strength.
10. Fire rating design listings and numbers by Omega Point Laboratories, Inc.

Modified ASTM E84 and ASTM E119 test reports are on file with the department.

LIMITATIONS OF APPROVAL

The limitations below are in accordance with the current **Wisconsin Uniform Dwelling Code (UDC), (for 1 & 2 family dwellings):**

- **Foam Plastic:** The Reward Wall Systems® Incorporated eForm and iForm insulating concrete form systems are approved for use with a thermal barrier to separate the blocks from interior spaces in accordance with **s. Comm 21.11(1)**. Where a 1-inch thickness of masonry does not separate the polystyrene blocks from the building interior, including at the top of the wall, a thermal barrier, which has a finish rating of at least 15 minutes, shall be provided.

1. The Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms are approved for use in combustible non-rated construction in accordance with **s. Comm 21.11**. In one- or two-family dwellings, thermal barriers shall be provided to separate the forms from the occupied space of the dwellings per **s. Comm 21.11**.
2. The exterior face of the blocks shall be finished with an approved weather covering and must be protected from ultraviolet light.
3. Reward Wall Systems® insulating concrete forms may remain uncovered on the interior of crawl space walls provided:

a) the floor between the crawl space and the occupied space consists of at least ¾-inch tongue and groove plywood sheathing or equivalent,
b) the crawl space is not used for storage or air handling purposes, there are no interconnected basement areas and
c) entry to the crawl space is **only** for service of utilities.

- ***Structural:** The Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms are approved as form-work for structural building elements.

1. The units are approved for use as concrete forms for basement walls and exterior walls when the resulting concrete core thickness satisfies **Table 21.18-A** for one- and two-family dwellings, or when structural calculations for the product are submitted for review.
2. Walls shall be anchored to all floors and roofs. Walls shall be interconnected at corners by embedding and lapping the reinforcement.
3. One- and two-family dwellings are **limited** to two stories in height plus a basement.
4. The forms are approved for use as concrete forms for basement walls, exterior walls and retaining walls when structural calculations are submitted to the department by a Wisconsin registered professional engineer or architect.
5. Below grade walls shall be damp-proofed or waterproofed when required by the local building department.
6. Damp-proofing and water-proofing materials shall be approved by Reward Wall Systems®, Inc., and the local building official, and shall be free of solvents that will adversely affect the EPS foam.

***Alternate Design**: In lieu of calculations, the structural design of reinforced concrete formed by Reward Wall Systems® Incorporated eForm and iForm insulating concrete form blocks for one- and two-family residential construction will comply with the *Prescriptive Method for Insulating Concrete Forms in Residential Construction* (publication No. EB118), dated May 1998, published by the Portland Cement Association (PCA). Buildings constructed with the Reward Wall Systems® Incorporated eForm and iForm insulating concrete form systems and designed in accordance with the alternate design, will not exceed a height of two stories plus a basement, where the maximum unsupported wall height is 10 feet.

- **Thermal Performance:** The Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms will meet the thermal performance calculation requirements of **s. Comm 22.31**. The Reward Wall Systems® Incorporated eForm and iForm insulating concrete form systems were **not** evaluated for compliance with the thermal requirements of **Subchapter VI, ss. Comm 22.20**, **22.21**, **22.23**, **22.25**, **22.27**, **22.28**, and **22.31** of the current UDC.

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Building Code Applicable to Projects Submitted for Review Prior to July 1, 2002: The **Comm** limitations below are in accordance with the **Wisconsin Building and Heating, Ventilating and Air Conditioning Code:**

- **Foam Plastic:** The Reward Wall Systems® Incorporated eForm and iForm insulating concrete form systems are approved for use with a thermal barrier to separate the blocks from interior spaces in accordance with **s. Comm**

51.06(3). Where a 1-inch thickness of masonry does not separate the polystyrene blocks from the building interior, including at the top of the wall, a thermal barrier, which has a finish rating of at least 15 minutes, shall be provided.

1. Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms are approved for use in noncombustible 0-hour rated construction in accordance with **s. Comm 51.06(4)(c)**. A thermal barrier per **s. Comm 51.06(3)** and noncombustible cladding per **s. Comm 51.06(4)(c)3.** shall be provided.
2. Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms are approved for use in combustible non-rated construction in accordance with **s. Comm 51.06(3)d.** Thermal barriers and noncombustible cladding shall be provided per **s. Comm 51.06(3)d.**, where applicable.
3. The exterior face of the blocks shall be finished with an approved weather covering and must be protected from ultraviolet light in accordance with **s. Comm 51.06(5)(f)**.
4. Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms may remain uncovered on the interior side of crawl space walls provided: the floor between the crawl space and the occupied space consists of at least ¾-inch tongue and grove plywood sheathing or equivalent. The crawl space shall not be used for storage or air-handling purposes, no interconnected basement areas and entry to the crawl space is only for service of utilities.

- **Structural:** The Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms are approved as form-work for structural building elements. Minimum reinforcement for walls shall conform to **s. Comm 53.316**.

1. Commercial and multi-family structures are **limited** in story height in accordance with **s. Comm 51.02(14)**, **s. Comm 51.02(21)**, **s. Comm 51.03**, **Tables 51.03-A** and **51.03-C**, the construction, height and allowable area of the pertinent occupancy chapter and signed and sealed calculations.
2. These forms are approved for use as concrete forms for basement walls, exterior walls and retaining walls when structural calculations are submitted to the department by a Wisconsin registered professional engineer or architect.
3. Reward Wall Systems® insulating concrete forms may remain uncovered on the interior of crawl space walls provided:

a) the floor between the crawl space and the occupied space consists of at least ¾-inch tongue and groove plywood sheathing or equivalent,
b) the crawl space is not used for storage or air handling purposes, there are no interconnected basement areas and
c) entry to the crawl space is **only** for service of utilities.

4. Below grade walls shall be damp-proofed or waterproofed when required by the local building department.
5. Damp-proof and waterproof materials shall be approved by Reward Wall Systems®, Inc., and the local building official, and shall be free of solvents that will adversely affect the EPS foam.

NOTE: The Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms were **not** evaluated for compliance with the thermal requirements of **s. Comm 63.17** of the current Wisconsin Building and Heating, Ventilating and Air Conditioning Code.

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The **IBC** limitations cited below are in accordance with the **Wisconsin Amended IBC 2000 Code (effective 7/01/02):**

- **Foam Plastic:** The Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms are approved for use with a thermal barrier to separate the blocks from interior spaces in accordance with **s. IBC 2603.4.**

1. Where Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms are used in an attic or crawl space where entry is made to service utilities, the foam plastic insulation shall be protected. Protect the foam with mineral fiber insulation, wood structural panel, particleboard or hardboard, gypsum wallboard, corrosion-resistant steel or other approved material installed so the foam plastic is not exposed, in accordance with **s. IBC 2603.4.1.6**.
2. Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms may remain uncovered on the interior side of crawl space walls provided: the floor between the crawl space and the occupied space consists of at least ¾-inch tongue and grove plywood sheathing or equivalent. The crawl space shall not be used for storage or air-handling purposes, no interconnected basement areas and entry to the crawl space is only for service of utilities.
3. The protective covering shall be consistent with the requirements for the type of construction.
4. The exterior face of the blocks shall be finished with an approved weather covering and must be protected from ultraviolet light.

- **Structural:** Design of concrete formed by Reward Wall Systems® Incorporated eForm and iForm insulating concrete forms must comply with **IBC Chapter 19** with the following requirements:

1. The forms are approved for use as concrete forms for basement walls, exterior walls and retaining walls when signed and sealed structural calculations are submitted to the department by a Wisconsin registered professional engineer or architect.
2. Wall loading and lintel design will comply with the applicable provisions of **IBC Chapter 16.**
3. Design calculations of walls must comply with **s. IBC 1901.2.**
4. Minimum wall reinforcement shall conform to **s. IBC 1901.2**. When the code requires that vertical and horizontal reinforcement be spaced no further apart than 18 inches or three times the wall thickness, whichever is less, the maximum concrete wall thickness along the length of the wall is permitted to be used to determine rebar spacing.
5. Walls shall be anchored to floors and roofs in accordance with **s. IBC 1604.8.2**. Walls shall be interconnected at corners by embedding and lapping reinforcement in accordance with the code.
6. Design of shear walls shall be in accordance with **ss. IBC 1901.2** and **1910**.
6. Commercial and multi-family structures are **limited** in story height in accordance with **Chapters IBC 3**, **4**, **5**, and **6**, the construction, height and allowable area of the pertinent occupancy chapter and signed and sealed calculations.
7. Below grade walls shall be damp-proofed or waterproofed when required by the local building department, water-proofed in accordance with **s. IBC 1806**.
8. Damp-proof and waterproof materials shall be approved by Reward Wall Systems, Inc., and the local building official, and shall be free of solvents that will adversely affect the EPS foam.
9. Special inspection in accordance with **s. IBC 1704**, for placement of reinforcing steel and concrete, and for concrete cylinder testing, except that special inspection is not required for foundation stem walls conforming to **Table 1805.4.2** of the **IBC**. Additionally, when the building official approves, special inspection is not required when all of the following conditions are met:
    a) Wall systems are a maximum of 8 feet high and are limited to use in single-story construction of Group R-3, or Group U Occupancies.
    b) Maximum height of a concrete pour is 48 inches. Succeeding lifts must be placed in accordance with **s. IBC 1905.10.6**.
    c) Installation is by properly trained installers by Reward Wall Systems, Inc.
    d) The installation instructions indicate methods used to verify proper placement of concrete.
10. Walls constructed with Reward Wall Systems, Inc., eForm and iForm are considered Type V Construction.

NOTE: The Reward Wall Systems, Inc., eForm and iForm were **not** evaluated for compliance with the thermal requirements of **s. Comm 63.1018**.

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Reward Wall Systems® insulating concrete forms shall be installed in accordance with the manufacturer's installation instructions/manual.

Identification: Each package bears a label specifying the name and address of the manufacturer (Reward Wall Systems®, Incorporated; Omaha, NE). Additionally, product labels indicate the Wisconsin Building Product Evaluation Number (**200246-I**), and the name and logo of the quality control agency (Omega Point Laboratories).

This approval will be valid through December 31, 2007, unless manufacturing modifications are made to the product or a re-examination is deemed necessary by the department. The Wisconsin Building Product Evaluation number must be provided when plans that include this product are submitted for review.

DISCLAIMER

The department is in no way endorsing or advertising this product. This approval addresses only the specified applications for the product and does not waive any code requirement not specified in this document.

Revision Date:
Approval Date: October 8, 2002 By: _____

Lee E. Finley, Jr.
Product & Material Review
Integrated Services Bureau

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